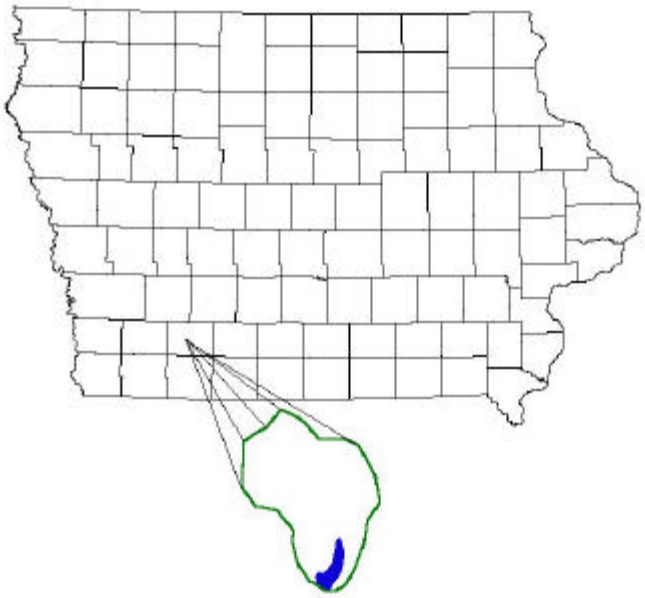
# Total Maximum Daily Load
# For Siltation
# West Lake - Corning (City Reservoir)
# Adams County, Iowa

July 2001

Iowa Department of Natural Resources
Water Resources Section

# TMDL for Siltation
# West Lake - Corning (City Reservoir)
# Adams County, Iowa

| | |
|---|---|
| Waterbody Name: | West Lake - Corning (City Reservoir) |
| IDNR Waterbody ID: | IA 05-NOD-00410-L |
| Hydrologic Unit Code: | HUC11 10240010030 |
| Location: | Sec. 26, T 72N, R 34W |
| Latitude: | 41 Deg. 00 Min. N |
| Longitude: | 94 Deg. 43 Min W |
| Use Designation Class: | B(LW) (aquatic life)<br>C (potable water source) |
| Watershed Area: | 426 acres |
| Lake Area: | Approx. 18 acres |
| Major River Basin: | Southern Iowa River Basin |
| Tributaries: | Unnamed intermittent streams |
| Receiving Water Body: | E. Nodaway River |
| Pollutant: | Siltation |
| Pollutant Sources: | Agricultural Non-point |
| Impaired Use: | B (LW) (aquatic life) |
| 1998 303d Priority: | High |



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## 1. Description of Waterbody and Watershed

West Lake - Corning (known locally as the City Reservoir) was built in 1915 as a potable water source for the city of Corning and is located in southwestern Iowa, 1mile northeast of Corning, Iowa. West Lake - Corning has a surface area of approximately 18 acres.

West Lake - Corning is owned and managed by the City of Corning. West Lake – Corning is one of a three-lake system used as the potable water source for the City of Corning. When the levels in West Lake – Corning drop, water is pumped from Lake Icaria or from Binder Lake. Water pumped from Lake Icaria goes into West Lake. The water from Binder is pumped directly to the city water plant, but because of the design of the system, a portion of the water pumped from Binder Lake flows into the Reservoir.

While the primary use of West Lake - Corning is potable water; local residents also use it for fishing. The West Lake - Corning watershed has an area of approximately 426 acres and has a watershed-to-lake ratio of 24:1. The land uses and associated areas for the watershed are shown in the table below.

**Table 1.** Land Use in West Lake - Corning Watershed (2001)

| Land use | Area in Acres | Percent of Total Area |
|---|---|---|
| Cropland | 55 | 13 |
| Pasture & Hayland | 278 | 65 |
| Urban/Residential | 29 | 7 |
| Barren/Sparse | 3 | <1 |
| Woods | 54 | 13 |
| Other (roads, etc) | 7 | <2 |
| Total | 426 | 100 |

## 2. Applicable Water Quality Standards

The Iowa Water Quality Standards (IAC, 1996) list the designated uses for West Lake - Corning as Aquatic Life (Class B (LW)) and Potable Water Source (Class C). The State of Iowa does not have numeric water quality standards for siltation. In the 1996 Department of Natural Resources (DNR) biennial water quality 305(b) report the fishable uses (Class B) for West Lake - Corning were assessed as partially supported due to excessive sediment from agricultural sources, based on information included in a water quality project application (Adams County – Three Lakes Project). This assessment was based on information collected during the 1994-1995 period. That assessment of partially supporting of Class B (LW) has continued to be used in subsequent biennial reports. Excess sediment impacts the Class B (LW) designated use by altering the physical and chemical characteristics of the lake so that a balanced community normally associated with lake-like conditions is not maintained (IAC 567-61.3(1)b(7)). The altering of the physical and chemical characteristics causes impairments of the following beneficial uses: 1) aquatic habitat; 2) spawning, reproduction and development; and, 3) sport fishing. In addition, siltation reduces food supplies by smothering benthic macro invertebrates.

## 3. Water Quality Conditions

The application for the Adams County Three Lakes Project stated that West Lake - Corning was primarily impaired due to sediment eroded from the watershed. The primary impact of sediment is interference with reproduction and growth of fish and other aquatic life. Excessive sediment deposition has lead to the lake being assessed as not meeting water quality standards.

The water quality of West Lake - Corning is not well documented. Water samples have been collected as part of the Three Lakes Water Quality Project. The University Hygienic Laboratory (UHL) conducted winter studies to assess the presence of herbicides in water supply reservoirs in Iowa in 1993 and 1995. These studies showed low levels of Atrazine in the water at West Lake - Corning (0.21 & 0.67 ug/l in 1993; 1.3 and 2.4 ug/l in 1995) and in the lake sediments (6.3 & 16 ug/Kg in 1993; 19.5 and 21ug/Kg in 1995). The report for the 1995 study states that the sediment concentrations of Atrazine were the highest observed during the study. It also states that the Maximum Contaminant Level (MCL) was not exceeded during this study. There are no known impairments to drinking water uses.

## 4. Desired Endpoint

The listing of West Lake - Corning is based on narrative criteria. There are no numeric criteria for siltation applicable to West Lake - Corning or its sources in Chapter 61 of the Iowa Water Quality Standards (IAC, 1996). Since excessive sediment deposition has impacted this water body, the endpoint needs to include both sediment loads to the lake, and measurement of the aquatic life within the lake. Therefore, this TMDL will incorporate two endpoints.

The first endpoint will deal with direct deposition of eroded sediment delivered to the lake. Endpoint number one for West Lake - Corning is to reduce the gross erosion rate from fields in the watershed to “T” and thereby reduce the corresponding delivery to the lake. “T is an estimate of the maximum average annual rate of erosion by wind or water that can occur without affecting crop productivity over a sustained period” (USDA-SCS, 1990). There are no significant contributions of sediment from gullies, streambeds, or shorelines to be considered. Reducing the erosion rate to T from fields in the West Lake - Corning watershed is expected to result in the protection of aquatic life by eliminating the adverse effects of excessive sediment loading to West Lake - Corning. This target load reduction is a reasonable initial estimate of needed reductions because it will result in an average rate of deposition in the lake low enough to minimize the impact on aquatic life.

The sediment delivery endpoints in Table 2 were calculated using the "Erosion and Sediment Delivery Procedure", Section I, Erosion Protection (USDA/NRCS, 1998). Endpoint values incorporating an erosion factor T, calculated from these delivery predictions, are in tons of sediment delivered per year. The resultant endpoint for this TMDL for West Lake - Corning will be 755 tons/year.

The second endpoint for this TMDL will be achieved when the fishery of West Lake - Corning is determined to be fully supporting the Class B aquatic life uses. This determination will be accomplished through an assessment conducted by the DNR Fisheries Bureau in either 2001 or 2002. The DNR Fisheries Bureau will conduct an assessment of West Lake - Corning in accordance with the Statewide Biological Sampling Plan protocol (Larscheid, 2001) by the end of the 2002 season to characterize the condition of aquatic life. IDNR Fisheries Bureau is using this protocol to help develop benchmarks for fishery integrity in Iowa lakes. Sampling techniques for these surveys are outlined in “Standard Gear and Techniques for Fisheries Surveys in Iowa”, 1995. This assessment will include growth, size structure, body condition, relative abundance, and species.

West Lake - Corning will not be considered restored until the Phase II endpoint is achieved. If the aquatic life endpoint is achieved prior to the sediment delivery endpoint, then the level of conservation practices implemented at the time of the assessment may become the baseline for the watershed. If however, after a reasonable time following the completion of the sediment

delivery practices the aquatic life use has not been restored, then further study and practices may be necessary.

## 5. Loading Capacity

The Iowa DNR has determined that reducing the gross erosion rate from fields in the watershed to T would enable the lake to meet water quality standards. “T is an estimate of the maximum average annual rate of erosion by wind or water that can occur without affecting crop productivity over a sustained period” (USDA-SCS, 1990). The erosion factor T in West Lake - Corning watershed is 4.43 t/a/y. Using an average delivery rate of 40% (from (USDA/NRCS, 1998)) would yield 1.8 t/a/y of sediment delivered to the lake at T. This totals 755 tons/year for the entire watershed on an annual basis.

## 6. Pollutant Sources

Water quality in West Lake – Corning is influenced only by non-point sources. There are no point source discharges in the watershed. Field investigations to determine landuses, cropping patterns, fertilizer use, conservation practices, livestock operations, and gully erosion were made in early 2001 by the local Soil and Water Conservation District (SWCD) office. Primary non-point sources in the watershed are cropland and pastureland. In 1996, the Adams County Soil and Water Conservation District implemented the Three Lakes Project, a water quality project to address these sources. The main focus of this water quality project has been to reduce sediment and associated contaminant delivery to the lake. An additional source is a section of prairie immediately north of the lake that has been disturbed for construction purposes.

Non-point source pollution is caused by material transported to the lake by runoff from the watershed. Gully, streambank/streambed, sheet and rill, and shoreline erosion can contribute significantly to poor water quality and deterioration of the lake. There is no gully, shoreline, or streambank/streambed erosion in the West Lake – Corning watershed. Although all land within a watershed contributes to sediment runoff, the main sources of this pollutant in the West Lake – Corning watershed are sheet and rill erosion from agricultural fields and from exposed soil areas.

The drinking water treatment plant for the City of Corning is located at West Lake – Corning. In order to maintain an adequate supply of water for the city, raw water is pumped from both Lake Icaria and Binder Lake to West Lake – Corning for processing. Any sediment contained in this raw water has the potential to influence water quality in West Lake. Calculations were made to predict the sediment influence from the water transfer process. The average number of gallons per year pumped into West Lake – Corning from Lake Icaria and Binder Lake came from data provided by the Corning Water Superintendent, Mike Goldsmith (Goldsmith, 2001), over the last sixteen months. The calculations used the Inorganic Suspended Solids (ISS) collected from Lake Icaria during Water Quality studies conducted by Iowa State University (ISU) as part of the Clean Lakes Classification Study in 1990, and as part of the Iowa Lakes Survey data collected during the field season 2000. No similar ISS data is available for Binder Lake, but because the watersheds are similar in soil type, topography, land use, and practices, it was assumed that the quality of the water is similar as well. The final predicted contribution from Binder and Icaria amounts to less than ½% of the Load Capacity calculated in Table 2. This was considered negligible, and was therefore not included in the source table. A table of the calculations and assumptions is included in the DNR file for this lake, and is available upon request.

The Three Lakes Water Quality Project has been implementing upland conservation measures in the Lake Icaria, Binder Lake, and West Lake - Corning watersheds since 1996. Best management practices installed in the watersheds include terraces, grade stabilization structures, and planned grazing systems. In addition to continued work on private lands, areas on public lands have been identified that would benefit from the construction of grade stabilization structures or wetlands.

# 7. Pollutant Allocation

## 7.1 Point Sources

There are no point discharges within the West Lake Corning (City Reservoir) watershed. The Wasteload Allocation established under this TMDL is zero.

## 7.2 Non-Point Sources

Cropland accounts for 13% of the land use for the West Lake - Corning watershed. Timber areas account for another 13%. Calculations include only average sheet and rill erosion for the entire watershed, although the greatest amount of gross erosion appears to be coming from several concentrated areas.

Sediment delivery estimates were determined by using the Erosion and Sediment Delivery, Section I, Erosion Protection (USDA/NRCS, 1998). The following equation was used to calculate sediment delivery to West Lake - Corning:

Sediment Delivery (t/y) = Drainage Area x Gross Erosion Rate x SDR x Gully Factor

Where: Drainage Area is the subwatershed in acres
Gross Erosion is 4.43 Tons/acre/year (T)
SDR is the Sediment Delivery Rate = 40%
(Taken from Chart 1, “Estimated Sediment Delivery for Landform Regions” using drainage area in acres. (USDA/NRCS, 1998))
Gully Factor is determined by the activity in the watershed:
(When no gullies are present this factor is 1)

Calculations were made for the watershed using this sediment delivery equation. The total sediment delivery for the West Lake – Corning watershed was obtained. The Load Capacity established to support the endpoint of this TMDL is 755 tons/year of sediment delivered to West Lake - Corning. A reduction in total sediment delivered will improve water quality by allowing the lake to “maintain a balanced community normally associated with lake-like conditions” (IAC, 1996).

Table 2 shows the Load Capacity representing a reduction to T.

**Table 2.** Sediment delivery to West Lake - Corning (T/Y).

| Source | Acres | Load Capacity |
|---|---|---|
| Sheet and Rill | 426 | 755 |

## 7.3 Load Allocation and Margin of Safety

An implicit margin of safety is recognized by virtue of the fact that the aquatic life use must be restored to West Lake - Corning. The use of the dual endpoints of 1) sediment load reduction and 2) aquatic life assessment assures that the uses will be restored regardless of the accuracy of the sediment delivery endpoint. Failure to achieve water quality standards will trigger review

and probable revision of the TMDL, allocations, and/or further sediment source management approaches.

## 8. Seasonal Variation

It is expected that the majority of all erosion in the West Lake – Corning watershed occurs in the spring and early summer during periods of high rainfall when the vegetative cover may be reduced. This TMDL recognizes that sediment loading and transport varies substantially from year to year as well as seasonally. In addition, sediment impacts are felt over longer timeframes, and predictions regarding those impacts can only be assessed over multi-year periods. Therefore, the Load Allocations in this document are appropriate when expressed as an average per year.

## 9. Implementation

The Iowa Department of Natural Resources recognizes that an implementation plan is not a required component of a Total Maximum Daily Load. However, the IDNR offers a two-phase implementation strategy to improve water quality at West Lake - Corning.

There are two parts to addressing the water quality issues involved at West Lake - Corning. The primary impact of sediment at West Lake - Corning is interference with reproduction and growth of fish and other aquatic life. Habitat degradation as a result of excess sediment contributes to the lake being assessed as not meeting water quality standards. Phase I of this TMDL reduces the sediment delivery to the lake. This would stop the continuing negative impact to the lake. Phase II includes the restoration of the fishery to a level that fully supports the Class B aquatic life uses.

Phase I: Field investigations to determine landuses, cropping patterns, fertilizer use, conservation practices, livestock operations, and gully erosion were made in early 2001 by the local Soil and Water Conservation District (SWCD) office. Estimates used “Predicting Rainfall Erosion Losses, The Revised Universal Soil Loss Equation (RUSLE)” Section I, Erosion Prediction (USDA/NRCS 2000) for sheet and rill erosion; and “Erosion and Sediment Delivery Procedure”, Section I, Erosion Protection (USDA/NRCS 1998) for the sediment delivery factors. Pertinent calculations can be found in Appendix I. These two calculations are generally accepted in the agricultural community as simple and straightforward methods for determining gross erosion and its resultant delivery to a body of water. Using landuse and practices supplied by the Adams County Soil and Water Conservation District (Waters, 2001), it is estimated that the current (2001) sediment load to the lake is 569 tons/year. Calculations in this TMDL include only average sheet and rill erosion for the entire watershed, although the greatest amount of gross erosion seems to be coming from several concentrated areas. A plan to implement practices in those areas could result in a dramatic reduction in the sediment load to the lake.

The Three Lakes Water Quality Project has been implementing upland conservation measures in the Lake Icaria, Binder Lake, and West Lake - Corning watersheds since 1996. Best management practices installed in the watersheds include terraces, grade stabilization structures, and planned grazing systems. In addition to continued work on private lands, areas on public lands have been identified that would benefit from the construction of grade stabilization structures or wetlands. In further support of Phase I, the Adams County Soil and Water Conservation District has applied for a grant from Clean Water Act Section 319 to implement a second phase of the Three Lakes Project. Construction projects funded by Section

319 grants are subject to the provisions of the Endangered Species Act. Any projects within the watershed that utilize federal funds will consider any endangered species.

Phase II: The DNR Fisheries Bureau will conduct an assessment of West Lake - Corning in accordance with the Statewide Biological Sampling Plan protocol (Larscheid, 2001) by the end of the 2002 season to characterize the condition of aquatic life. Sampling techniques for these surveys are outlined in "Standard Gear and Techniques for Fisheries Surveys in Iowa", 1995. This assessment will include growth, size structure, body condition, relative abundance, and species.

Supplemental water quality monitoring has been implemented by the City of Corning in conjunction with the SWCD Office for both West Lake – Corning and Binder Lake for a reduced number of parameters to compare with the Iowa Lakes Survey at Lake Icaria, 2000-2005.

## 10. Public Participation

Public meetings regarding the procedure and timetable for developing the West Lake - Corning TMDL were held on January 17, 2001, in Des Moines, Iowa; and on February 1, 2001 in Corning, Iowa. Another meeting was held in the watershed in June 11, 2001 to discuss the draft document. Comments received, where appropriate, were incorporated into the final document.

## 11. References

IAC, 1996. *Iowa Administrative Code 567, Chapter 61, Iowa Water Quality Standards.*

Kennedy, J.O. and J.G. Miller. 1993. Herbicides in Water and Sediment from 15 Iowa Water Supply Reservoirs, January-March, 1993. Report 93-3. University Hygienic Laboratory, University of Iowa, Iowa City, Iowa. 60 p.

Kennedy, J.O. and J.G. Miller. 1995. Study of Herbicides in Water and Sediment from 19 Iowa Water Supply Reservoirs, January-February, 1995. Report 95-1. University Hygienic Laboratory, University of Iowa, Iowa City, Iowa. 60 p.

Larscheid, Joe. Statewide Biological Sampling Plan, July 2001.

USDA/Natural Resources Conservation Service. 1998. Field Office Technical Guide Notice No. IA-198. "Erosion and Sediment Delivery Procedure", Section I, Erosion Protection.

Waters, Bob. Environmental Specialist. Adams County Soil and Water Conservation District. Personal Communication, May 2001

USDA-SCS. 1963. United States Department of Agriculture, Soil Conservation Service. May 1963. Soil Survey of Adams County, Iowa.

Goldsmith, Mike. Water Superintendent, City of Corning Water Department, Adams County. Personal Communication, May 2001.

# 12. Appendix I

**PREDICTING RAINFALL EROSION LOSSES THE REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)**

The equation is expressed as follows: A = RKLSCP where:
A = average annual soil loss from inter-rill (sheet) and rill erosion caused by rainfall and its associated overland flow expressed in tons/ac/yr,

R = the factor for climatic erodibility,
K = the factor for soil erodibility measured under a standard condition,
L = the factor for slope length,
S = the factor for slope steepness,
C = the factor for cover-management, and
P = the factor for support practices.

Example calculation from West Lake - Corning Watershed:

A= ?
R= 170 rainfall factor
K= 0.26 erodibility factor (by soil type)
LS= 3.6 length / slope
C= 0.39 cropping factor
P= 1.00 practice factor (ex: 0% reduction, therefore 100% of load)

A= (170) (0.26) (3.6) (0.39) (1.0)
= 62.0568 t/a/y
= 62.0 t/a/y

# 13. Appendix II

**Figure 1**

West Lake - Corning Watershed